Mars Magnetometer Balloon Mission

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The recent detection of strong remanent magnetism in the ancient crust of the Terra Sirenum region of Mars by Mars Global Surveyor (MGS) has stimulated a reanalysis of the history of the Mars internal magnetic field and the crustal accretion process. Although these MGS data are providing a wealth of information to support new models of the early evolution of Mars, it is difficult to place firm constraints on these models because several fundamental characteristics of the magnetic anomaly pattern are lacking. These characteristics are the spatial frequency of the pattern, and the depth, thickness and lateral extent of the sources. Low altitude magnetic field observations are required to reveal these characteristics, as well as to test the hypothesis that the Martian magnetic field decayed very early in the planet's evolution. A balloon-borne magnetometer mission is an effective and attractive way to obtain the magnetic field observations at low altitude.

A possible profile for such a mission would have a super-pressurized balloon deployed from a microsatellite spacecraft bus. The microspacecraft would be launched as an ASAP payload on an Ariane V. The target for insertion would be the Terra Sirenum region, in the southern mid-latitudes, at an altitude of ~2 km from the surface. The drift of the balloon over its ten-day mission would be dominantly zonal, generally at an oblique angle to the magnetic lineations. One or more vector magnetometer(s) and ancillary attitude and navigation sensors would comprise the instrument payload. A communication relay would be used to send the data to Earth. It is expected that this type of mission could provide key constraints on the early evolution of Mars, as discussed above, at very low cost.